

Rocky Flats Environmental Technology Site Actinide Migration Evaluation
Meetings October 13-15, 2003
Advisory Group Greg Choppin, David Clark, David Janecky, and Leonard Lane

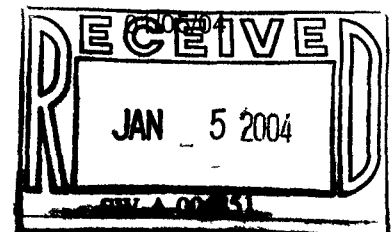
Summary and Recommendations for Path Forward

This meeting was focused on a review of Actinide Migration Evaluation (AME) activities and integration with site D&D and remediation. How this focuses on contract completion work over the next two years was discussed with Kaiser-Hill and DOE management. A visit by Dr. Theresa Fryberger of US DOE Office of Science (and formerly US Department of Energy [DOE] Environmental Management) provided the opportunity for a site tour, discussions of new approach utilization by Kaiser-Hill and subcontractors, and continued integration of technical review and advice through the AME.

The changes in the site due to building removal and remediation are tremendous. Two key areas of attention for the near-term are (1) planning for retention of a select set of roads necessary for continuing site activities after closure (e.g. operation of retention ponds and reactive barrier systems) and (2) planning for remediation of the 903 Pad lip area. Other areas of interest to the AME advisors for discussion at the next meeting include the 900-11 IM/IRA documentation, progress of contamination monitoring and characterization (e.g. U, as well as Pu and Am), documentation of 903 Pad removed soil characterization and disposal, and guidelines for documentation of Site operations that span closure. The Advisors would like to see additional information on the new Legacy Management (LM) program and how the ER and LM programs will interact to provide documentation and guidance for Site operations (i.e. ponds, reactive barriers, and maintenance roads) that span remediation and closure and extend into stewardship.

Progress and Integration

The Advisors are pleased to see increased integration of modeling technology being used in ER activities such as evaluation of the 903 Lip area remediation and post-closure water quality impacts and re-configuration analyses.



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Results and Discussions

Actinide Migration Evaluation, issues in 1995 through current conditions

A site tour and photo presentation of status from 1995 to present initiated the meeting, with contributions from Bob Nininger, Laurie Gregory-Frost, Annette Primrose, Ian Paton, Craig Hoffman and Mike Harris. Following the tour, Laurie Gregory-Frost and Bob Nininger presented a brief review of the history of Rocky Flats from inception of construction in 1951, through operations (1952-1992) the present decommissioning and decontamination (D&D) and remediation (1995-present). This provided the background to the present issues remaining before closure. One emphasis was the source in the operational era of the contamination by actinide and organic contaminants, which are currently being addressed.

Of particular value was the discussion of the closure project performance to date and the remaining closure challenges. These led to discussion of several current issues such as the increasing problems as closure approaches, of the loss of trained employees needed to finish projects, and resolution of a disposition pathway for some low level mixed and TRU-mixed waste. A risk level of $\leq 10^{-16}$ is the criterion for acceptable remediation. This risk level is interpreted as a residual plutonium (Pu) contamination of $\leq 0.15 \text{ pCi/L}$.

Chris Dayton presented the history of the AME group. It was initiated in 1995 with an associated review team to provide independent review and advice on actinide migration issues at the Rocky Flats Site. Early endeavors of the AME group were the development of a conceptual model, and use of advanced research methods to obtain the needed data for assessment of this model. The results of these endeavors were summarized in 2002 in a Pathway Analysis Report. Studies aimed at validation of the conceptual model provide valuable understanding of the factors involved in actinide migration. For Pu/amerium (Am), dispersion by air was found to be a larger pathway than that by water due to the colloidal (particulate) nature of the transported Pu/Am. By contrast, transport by water is more important for uranium (U), due to its relatively high aqueous solubility. Examples were given of data obtained by the AME to confirm the effects of this difference (colloidal vs. dissolved) in Pu/Am and U behavior in such critical sites as the 903 pad. This led to use of more realistic and reliable models for actinide transport.

Overall, this was a brief, valuable history of the RFETS and the progress and present status of the work to achieve closure prior to stewardship. The principal audience was Theresa Fryberger (USDOE-EMSP). It provides valuable information to other DOE sites that are approaching similar D&D and remediation work for eventual site closure.

Formation of the AME, the external advisor group, how we function, and the role of public meetings

The AME Advisory group was formed to provide guidance on issues of actinide behavior and mobility in the air, surface water, groundwater, and soil. The members of the advisory group are constantly changing. New members are added to provide expertise on current issues to the Site, and active advisors rotate off the group when specific questions related to their expertise are resolved. The AME group meets approximately once per quarter, and often in conjunction with stakeholder meetings.

From its inception, AME advisors have acted as independent experts on actinide studies related to the RFETS, and have not been involved in the capacity of principal investigators to resolve RFETS actinide migration questions. Advisor independence is crucial for maintaining an environment in which the advisors can provide unbiased guidance and review of scientific investigations. To clarify the advisor-client relationship, a Memorandum of Understanding (MOU) was written for the AME group members, DOE, and Kaiser-Hill, which spells out roles and responsibilities of the various team members.

A central principle of the AME has been to have ongoing interaction with the public and stakeholder groups. As actinide migration-related studies are performed and completed, meetings are held with representatives from the regulatory agencies, neighboring communities, and citizens' groups to discuss study results and the implications for remedial actions at the Site. If warranted, additional personnel are brought in to provide expert opinions as necessary (e.g., chemists experienced with specialized analytical techniques, climatologists experienced with air transport and modeling). Discussion of issues occurs in the public forums and has prompted additional research to be conducted to address unanswered questions.

Kaiser-Hill's use of science and advanced technologies (through EM- and RFETS-funded activities) to guide business and cleanup decisions at RFETS

Russell McCallister on behalf of Gary Hoffman provided a review of the key accomplishments and use of science and advanced technologies. The areas of orphan wastes, environmental restoration, and D&D were particularly highlighted.

Orphan waste is a continuing and unresolved concern, as there is, at present, no defined disposal path for a number of materials present at Rocky Flats.

For completion of environmental restoration, the use of an evapotranspiration (ET) cover may be technically sound and perhaps better than the system(s) now in use. However, regulatory issues now prevent use at Rocky Flats. The use of a soil vacuum/precision excavation technique was tested, but given the depth to which contamination was found (up to 20 cm), disturbance of

the vegetation was too extensive for application to the 903 Pad lip area. A number of other on-going studies of new technologies were also described.

Also described were the proposed projects and funding requests for 2004. These projects have been given priority ranking to ensure funding of the more urgent ones. The AME advisory group was also provided with an extensive list of technology studies, demonstrations and deployments at Rocky Flats from 1997-2003. However, the list was not described nor was any evaluation of results of demonstrations and/or deployments provided. This limits the value of this information for future application and extension at Rocky Flats or other sites.

Environmental Restoration projects conducted with EM funds and lessons learned

Lane Butler (ER) presented a summary of US DOE Environmental Management Science & Technology (EM50) supported projects at RFETS and concluded that EM50 support had significantly affected successful closure activities. These projects and activities included the following:

Testing and design of groundwater reactive barrier systems resulted in installation of systems at RFETS.

- 1) Solar Ponds groundwater treatment systems consisting of tandem chambers filled with sawdust and iron filings to treat nitrate and U plumes. These barriers are working well and have a projected life before requiring replacement of the reactive media of 5 to 10 years. ER personnel have estimated that this system will need to be in place for approximately 30 years following closure. This extends well into the stewardship phase.
- 2) Mound Plume. These have a projected 5-10 years media life and 30 year operating life following closure. This passive reactive barrier is being used to treat VOC's and radionuclides (Am, U). So far this system has performed well without plugging of the chambers and has remained effective with treated water meeting standards for discharge to the environment. This system also will be needed into the stewardship phase.
- 3) East trenches. These are treated using reactive barrier cells for VOC contaminated groundwater captured by a 1200 foot long French drain. However, the reactive media here only lasted 4 years before breakthrough of contaminants were detected, and the iron filings are now being replaced with a different type of filings that have lasted longer at other locations. Presumably, these barriers will be needed well past closure and into the stewardship phase, but projected duration of their need was not discussed.

The requirement that these reactive barrier systems will protect surface water quality well beyond closure and into the transition and stewardship periods.

and will thus require monitoring, periodic maintenance, and access roads for heavy equipment is of concern to the Advisors. Lane Butler stated that they do have a post-closure O&M document for these systems. This is critical to stewardship and we commend ER for their foresight in this instance. However, subsequent group discussions revealed that there are no Site-wide criteria for development, peer review, publication, and implementation of documents for operation, maintenance, monitoring, evaluation, and any additional remediation that may be required during transition and into stewardship.

The Advisors were told that preparation of the criteria guiding development of post-closure procedures and documents was beyond the scope of ER responsibility and was the responsibility of the newly formed "Legacy Management (LM)" program. The advisors feel the formation of this new LM group with these post-closure responsibilities can be a significant and positive development. However, we are concerned that their responsibilities, functions, and activities be defined and implemented very quickly so that they can positively influence the transition to stewardship and help shape subsequent stewardship operations. We feel that this is a critical and priority need.

Lane Butler also described investigations and proposed application of evapotranspiration (ET) covers for Site landfills but the designs could not meet all of the regulator requirements (e.g. no flow below the trench cap) requiring extensive long term monitoring. Therefore, ER decided to apply the standard RCRA cap to avoid these problems.

Lane Butler and Bob Davis presented results and evaluations for the precision soil excavation (i.e. vacuum technology). In general, the results were disappointing technically (problems of rocks and large vegetation crowns, depth of soil removal, machine reliability, etc.) and economically due to the slow treatment rates per unit area. Alternative means of contaminated soil removal, such as excavation, will be used in the 903 pad lip area.

AME/ER Project Exchange, status of 903 Pad remediation project

Lane Butler presented an overview of the status of the 903 Pad remediation. In general, the remediation effort has progressed exceptionally well, with 210 cells completed, and only 15 remaining. The experience gained during this effort will be invaluable when the team moves on to the Lip operations. The advisors applaud the use of tents during this operation, as it provides both weather protection for the workers, and a secondary barrier to prevent wind dispersal of actinides during remediation activities. There are a number of issues associated with continuing this practice as the team moves to the Lip area due to the presence of steep and variable slopes. It is particularly important to consider the proper staging of operations to decontaminate from high contamination to low, and from upslope to downslope to avoid recontamination as the overall remediation proceeds.

Erosion Modeling and Lip Area IM/IRA Update

Ian Paton described modeling results for conditions after remediation of the 903 Lip Area. WEPP and Actinide Mobility Modeling results were shown for five alternatives to control erosion (and associated Pu/Am transport) following remediation. These alternatives included no action, extending the South Interceptor Ditch (SID) eastward to intercept runoff and sediment transport from hillslopes below the Lip area, and other alternatives involving erosion control measures on hillslope elements below the lip area. The graphic representations of the alternatives (especially alternatives 4 and 5) need to be corrected to match the actual overland flow elements used in the WEPP modeling.

The alternatives were shown to provide various levels of surface water protection and it was apparent that a combination of the SID extension, application of hillslope erosion control measures and maintenance of Pond C-2 could be used to meet the surface water standards. Wetland and wildlife habitat impacts were also discussed.

It was not clear how the issues of longevity and effectiveness of the SID extension-surface erosion control and Pond C-2 combined water quality control measures would be addressed in the modeling analyses and how they would be maintained beyond closure and into stewardship. The Advisors feel these analyses and maintenance plans should be explicitly addressed in the Lip Area IM/IRA documents.

Erosion Modeling & Probability Analysis

Ian Paton and Win Chromec presented a methodology and results for utilizing Site data, the WEPP erosion model, the HEC6T sediment transport model, and the actinide mobility calculations procedures to generate time series of actinide loading in stream flow. These results were then statistically related to long-term precipitation data to derive a relationship between precipitation and actinide concentrations for calculation of 30-day, moving average mean Pu concentrations at the Points of Compliance (POCs). These calculated 30-day, moving averages were then compared with the surface water 0.15 pCi/L standard. This provides the Site with a methodology to evaluate the probability of exceeding the surface water standards under existing and post closure conditions. A significant part of this development was that both monitoring data and modeling results were utilized to capture data, modeling interpretations, and knowledge. This provides the Site with a heretofore unavailable procedure for evaluation of the probability of surface water standard exceedances under a variety of alternative post closure configurations.

Uranium action levels for Building 881

The AME group discussed issues surrounding the B881 cleanup with regard to U RSALS. In general, no U problem has been observed in surface water in Woman Creek since 1996. The amount of U found in these surface

waters is always about one order of magnitude below the 11 pCi/L standard. Moreover, no well water monitoring data have shown a signature for anthropogenic U near B881. Thus, there is no evidence that there is a pre-existing problem with U contamination outside of the building.

Pu to Am Ratio in Environmental Samples

Recognition that Pu and Am character and migration in the environment are dominated by particulate and/or colloidal materials has led to broad use of gamma analysis as a rapid, field-able, characterization approach and evaluation of derived ratios as signatures (especially $^{239+240}\text{Pu}/^{241}\text{Am}$). Integration and propagation of uncertainties is essential for evaluation, including sufficient analytical description and comparative samples to quantify both measurement bias and random error. It must also be recognized that approaches are different for use as decision criteria *versus* use in differentiation of sources. For source differentiation, an average population value or range may be appropriate, while for decision criteria, a level of confidence required for the decision must be established and the maximum range used.

Roads and grading plan

Bob Davis presented a Site map illustrating the some re-grading (re-configuration and re-contouring) alternatives under consideration for closure. These included borrow areas, engineered channels, and removal of features such as paved roads. The re-configuration is designed to meet surface water quality standards and remediation to wildlife sanctuary status. The Advisors are pleased to see the integration of Site-developed modeling technology applied to analysis and evaluation of runoff, erosion, and contaminant transport from the re-configured Site.

It is recognized, however, that maintenance roads will be required at closure and into stewardship and the Advisors do not feel that these roads and their impacts have been given sufficient attention in the re-configuration analyses. How many roads of what size and properties will be required? How will they be maintained? What will be their impact on post-closure water quality at the POC's? It is not clear how stakeholders will be involved in these decisions or how the re-configuration process will be coordinated with the re-seeding/re-vegetation activities. Again, the Advisors would like to see the analyses and plans documented for now, for closure, and into stewardship.

Uranium Contamination Issues – Elizabeth Pottorff of CDPHE

The use of U isotopic analyses by High Resolution Inductively-Coupled Plasma/Mass Spectrometry (HRICP/MS) has provided a very effective method for characterization and excellent differentiation between contamination and background. For example, water samples from wells in weathered bedrock

associated with Building 881 showed natural U. There is consensus between CDPHE and the Site that there is no further need to investigate potential contamination. At this point, there are no specific sites identified for further investigation and analyses. Kaiser-Hill, DOE, and CDPHE will continue to evaluate remedial actions and sites for future investigation.

Scientific Transition to Stewardship and what is new in Adaptive Management

An update on adaptive management (AM) was presented. Approximately a year and a half ago, the AME Advisors discussed adaptive management as a means for Kaiser-Hill, DOE, and others to manage closure and transition to stewardship at RFETS. In the spring of 2003, a Transition to Stewardship White Paper and a corresponding PowerPoint presentation were prepared. Presentations were made to the public (including DOE and K-H) in May 2003. Finally, in June 2003, a "summary" transition to stewardship paper was developed and is now being prepared for submission to K-H management.

Concurrently with these AME developments, important activities were taking place at the national level. The National Research Council published a book entitled "Environmental Cleanup at Navy Facilities: Adaptive Site Management." In this report the NRC made a number of significant recommendations including "The Navy and other federal agencies should adopt adaptive site management" and "A government-wide policy for long-term stewardship (also known as long term management) at federal sites is needed" (see <http://books.nap.edu/catalog/10599.html>).

The Council on Environmental Quality (White House level) formed a task force to prepare a report entitled "The NEPA Task Force Report to the Council on Environmental Quality: Modernizing NEPA Implementation", September 2003 (see <http://ceq.eh.doe.gov/ntf/report/index.html>). This report included the recommendation that the NEPA process be improved using AM. More specifically, that "the task force recommends the CEQ convene an AM work group to assess the applicability of NEPA guidance and regulations related to AM and to consider integrating the NEPA process with environmental management systems."

The AME Advisors believe that with the National Academy of Sciences – National Research Council report and the Council on Environmental Quality report recommending agency and government-wide adaptive management and stewardship policies means that future remediation of Superfund sites will utilize adaptive management and more formalized long-term stewardship activities in conjunction with adaptive management. We also feel that there is still time and value for RFETS to demonstrate continued national leadership by formally adopting transition to stewardship and adaptive management.

Documents Provided to Advisory Group

Agenda
Rocky Flats History brochure
Site History viewgraph virtual tour presentation
Rocky Flats envision Oct 1, 2003 vol 9, number 19
AME viewgraph presentation
Advisor Role & Process (handwritten) viewgraph presentation
EM-50 Technology Deployments at Rocky Flats viewgraph presentation
Kaiser-Hill technology program 97-03 technical evaluation studies, demos and
deployments at Rocky Flats
Rocky Flats Environmental Technology Site ER EM-50 Projects (Lane Butler)
viewgraph presentation
903 pad update viewgraph presentation
Long-term stewardship – AME input on specific topics raised by DOE/RFFO
Runoff impacts of roads on erosion at DoD site viewgraph presentation
(Leonard Lane)
Chart A – Overall Characterization Process – 903 Pad Soils --- diagrams
Adaptive Mgmt review viewgraph presentation (Leonard Lane)
Conceptual alternative (preliminary draft) for 900-11 Area IM/IRA (Ian Paton)
900-11 Area IM/IRA viewgraph presentation (Ian Paton)

Documents and Information Requested for Advisory Group

Operation and Maintenance Manual for reactive barrier systems after closure
Operation and Maintenance Manual for pond operations after closure
Criteria for O&M Manual development for post closure
Need summary of monitoring data from in/around building 881 for U and wells,
surface water from seeps and Woman Creek

Requests for Future Presentations and Information

IM/IRA for 900-11

The Advisors would like to see additional information on the new Legacy
Management (LM) program and how the ER and LM programs will interact
to provide documentation and guidance for Site operations (i.e. ponds,
reactive barriers, maintenance roads) that span remediation and closure
and extend into stewardship

Participants in AME technical meetings**Name Organization**

Chris Dayton	Kaiser-Hill
Greg Choppin	Florida State
David Clark	Los Alamos
David Janecky	Los Alamos National Laboratory
Leonard Lane	Tucson
Theresa Fryberger	US DOE/OS/BER
Russell McCallister	DOE/RFFO
Robert Nininger	Kaiser-Hill
Ian Paton	Wright Water Engineers
Laurie Gregory-Frost	E2
Bob Prucha	Integrated Hydro Systems
Dave Malone	Kaiser-Hill
Craig Hoffman	Rocky Flats Closure Site Services
Annette Primrose	Kaiser-Hill
Mike Harris	Kaiser-Hill
Lane Butler	Kaiser-Hill
Bob Davis	Kaiser-Hill
Win Chromec	Kaiser-Hill
Mark Sattelberg	US Fish & Wildlife Service
Amy Thornberg	US Fish & Wildlife Service
David Shelton	Kaiser-Hill
Elizabeth Pottorff	Colorado Dept of Public Health & Environment

Future Meetings

February 2-4, 2004